INPUT INTO
U.S. BROADBAND COALITION
WORKING GROUP ON GOALS

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Information and Communications Technologies (ICT) is an umbrella term, widely used outside the U.S. and in the United Nations, to encompass all rapidly emerging, evolving and converging computer, software, networking, telecommunications, Internet, programming and information systems technologies.

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The Importance of Communications to Humanity

Even more than opposable thumbs, what sets human beings apart from other species, and has led to our extraordinary success, is our ability to communicate.

More than anything else, it is human ability to share experiences, thoughts, emotions and ideas - to learn from each other and cooperate with each other - that has enabled the rapid evolution and global dominance of humankind.

We communicate to feed, clothe and house ourselves. Through communications we assemble and pass on knowledge and technologies. We are able to divide labor and develop specialization in organized society through our ability to communicate. Via communications, we unite human minds in powerful feedback loops to develop powerful distributed thinking machines. We support, maintain and nurture each other via communications. Communication enables the exchange of goods, services, ideas, practices, systems, experiences, visions, plans, values, beliefs, observations, learning…

The human brain has developed its exceptional processing and storage capabilities as a direct result of human communications. Without communications an individual brain would be unable to acquire or accumulate enough personal experience or data to utilize or warrant its current capacities.

We communicate directly and in person through our five senses by observing each other, by speaking and listening to each other, through touch, smell and taste. We have also devised ways of communicating with each other over time, by recording ourselves in books and other media which can be accessed later. We have developed ways of tele-communicating over distances, so we don't have to be physically close to realize the powerful benefits of communication.

Behind every development of society, in every human relationship, there is communication. The earliest great human civilizations were realized through cuneiform and clay tablets in Sumeria, papyrus in Egypt and scrolls in the Middle East. The spread of Christianity and all other religions is a direct result of communications. The explosive benefits of the Renaissance are a direct result of the rediscovery of written communications preserved from ancient civilizations and of written correspondence between thinkers stimulated by those writings and by the ideas and inventions of each other. Massive human advancements in the industrial age were enabled by postal, radio, telegraph and telephone communications. The largest and most complex construction of humanity in the 20th century was the Public Switched Telephone Network, which enabled instant communications between humans around the world.

Benefits of every advance of science or technology result from communication. Every military success is a result of communication. Without communication there would be no society, government, education, commerce, agriculture, science, war, medical practice, history, law, entertainment or art.

Communications, more than anything else in human experience, enable the advancement of humanity. More than anything else, advances in our ability to communicate affect the advancement of humanity and humankind.

Given the importance of communications, shouldn't we as a society strategically invest the time, thought, energy and resources to maximize our ability to communicate? It is the societies that do that develop and progress most rapidly.

We have an opportunity right now to take human communications into a complete paradigm-shifting radical new dimension – the possibility of instantaneous real-time communications between anyone and anything worldwide with media so rich it is possible to believe that we have eliminated constraints of distance between us. We can record, store and make available those communications to anyone any time. All, for any purpose.

We are literally on the threshold of being able to transcend the physical constraints of distance and time to enable humanity to combine into a distributed, multi-processing and interactive whole, capable of creating almost infinite connections and feedback loops between us to exponentially expand our evolution and growth – in every dimension.

The Importance of Communications to You Personally

It doesn't matter who you are or what you do: development of improved communications systems and technology are to your benefit.

If you are now or at any time will in any way be associated with health care, as a professional or patient, it is to your benefit to have advanced communication systems, so that patient records, medical research, radiology files and medical expertise are available when and where needed.

If you or anyone you know will participate in any form of education, as a student, teacher, parent or interested party, it is to your advantage to have educational resources available when, where and how needed via modern communications capabilities.

If you have personal, public or business relationships with anybody anywhere, it is good for you to have advanced communications systems available and affordable for your use.

If you participate in any way in society you will benefit from modern communications.

If you enjoy entertainment in any form, it will be more accessible and available to you with modern communications capabilities.

Communications technology benefits you in your work, no matter what you do.

If you would like more leisure in your life, efficiencies enabled by communications technology can create more leisure.

If you have any personal or business interest whatsoever, you can pursue that interest more efficiently via modern communications tools.

If you seek any form of information from any source, advanced communications systems can help you.

It is irrelevant whether you are a Republican, Democrat, Independent, or whatever, what religion you do or do not practice, or what you do or do not do for a living, communications are important to you.

You will personally, directly and indirectly benefit from improved communications capabilities – no matter who you are or what you do.

The Importance of Communications to U.S. Economies

Directly and/or indirectly, in the information and knowledge economies of the 21st century, we all increasingly depend on information and communications technologies (ICT) - and the increased connectivity and productivity they enable. Improvements to deployed information and communications technologies, infrastructure, systems and solutions - and people's abilities to productively use them - are issues of tremendous strategic importance, to individuals and their families, organizations of all kinds, and local, state, national and global economies.

Recognizing this, many nations have adopted progressive public policies to promote and improve ICT infrastructure. The U.S. has had essentially no national public policy around communications technology infrastructure for a decade. It has taken a hands-off approach, decreasing regulation and hoping free market forces would serve public needs. (That strategy has certainly served us well in financial markets.)

In that period, we have seen a collapse of competition for local communications transport services, except for the most densely populated business centers, an

unwillingness to serve less profitable, dispersed populations, competition based largely on marketing hype, and the U.S. dropping rapidly in global measures of both the quality and reach of communications services.

In that period, we have also seen corporations exporting traditional U.S. industrial economy production and jobs overseas, where labor is cheaper and rules are more lax, at an extraordinary rate. These businesses continue to sell their products and services in the U.S., but they do not adequately participate in producing the income in the U.S. to pay for that consumption. As a result, these companies are ultimately engaged in the business of extracting wealth and livelihoods from U.S. society, reducing our standards of living and bankrupting our societies and economies.

It's too late to adequately change that outsourcing of industrial livelihood to preserve U.S. standards of living and economic performance. We have to replace those industrial economy jobs with information and knowledge economy jobs. To do that, we have to have the physical and technical infrastructure to support those new economy endeavors. For example:

Healthcare

With adequate information and communications technologies infrastructure in place, we have the opportunity to enable new ways of providing health care in this country. We can move to electronic patient charting and create the possibility of adequately sharing medical records between health care providers so they can provide fully informed care and decision-making services for the first time. Huge radiology and other patient imaging files can be sent almost instantaneously to obtain expert opinions from far away. Remote monitoring systems and services can be established to enable patients to live at home. Medical procedures, including surgery, can be performed remotely, saving lives in more remote areas. There are potential billions of dollars a year in economic activity enabled by adequate ICT infrastructure.

Entertainment

With adequate information and communications technologies infrastructure in place, we enable a host of entertainment products and services. It becomes possible to deliver high-definition video content at any time anywhere without delays. We enable content providers to deliver products and services without the large barriers to entry that exist today, creating businesses and jobs. We enable next generation high definition video experiences networks cannot handle today, like 4K. We enable the distribution of music at much higher fidelities than are practiced today and the virtual experiences of real time performances to people

anywhere. We enable artists and creative teams to collaborate efficiently across distances and virtual travel experiences. These are potentially billions of dollars a year in economic activity.

Gaming

Gaming is already a multi-billion a year industry. With high capacity network connectivity, we enable a whole new dimension in gaming: high-fidelity interactivity between players across distance. It is possible to play a virtual reality tennis game between players in New York and Los Angeles. It is possible to create extremely immersive gaming environment with very high definition screen displays or to connect multiple players simultaneously into extraordinarily rich, massive, multiplayer online games. It is possible to integrate real time video of real people into gaming environments. Together, these represent billions of dollars a year in new potential economic activity.

Online Trade and Commerce

Adequate communications technology infrastructure enables remote, rich media experiences of products and services, enabling efficient, remote buying decisions. It enables entirely new products, services and businesses, like remote psychological therapies, rich virtual worlds and virtual world services (like Second Life), event recordkeeping and archiving, remote video surveillance services, virtual trade fairs and conferences and things we cannot even imagine yet. Again, these are billions a year in possible economic benefit.

Education

Advanced ICT infrastructure would enable extremely rich media teaching and learning experiences across time and space, and it would allow efficient connectivity between expert teacher/mentor resources and interested learners in even extremely esoteric subjects. Students could gain remote, real world-like experiences with real world workplaces and employees. Guest lecturers could drop in from anywhere, any time. It becomes possible to explore almost any environment without leaving home or school. Students can connect with each other in rich, interactive working groups, where they learn the real world "soft" or "employability skills" so important to employers. Enabling improvements to education through technology enables improvement to everything the human mind can be applied to, creating billions in potential economic benefits.

Others

Almost any economic activity, industry or personal endeavor would be enabled by cutting edge ICT infrastructure. It is impossible to truly estimate the potential benefits resulting directly or indirectly from a truly high-performance and pervasive information and communications technologies infrastructure, because there are really no limits to what those potential benefits could be.

The Importance of ICT Infrastructure to Global Environment

The scientific world, public policy-makers and most of the general public are moving beyond debate about whether human beings are contributing to global warming and a rapidly approaching global ecological crisis. The new world focus is on how to reduce carbon emissions to fight global warming. Many of the strategies to do so depend on information and communications technologies and their underlying infrastructure. For example:

Smart Transportation:

The more we can replace physical travel with networked activities and virtual experiences, the more we can reduce energy consumption and greenhouse gas emissions. "Move electrons and photons, not atoms."

Strategies include:

- Networked connectivity to enable more people to work from home and reduce commute consumption and waste
- Networked connectivity to enable remote access to education services
- High-performance videoconferencing solutions, like Cisco's Telepresence, to reduce the need for business travel
- Networked distribution models to reduce trips to video stores and shipping of digital content
- Networked sensor and control device systems to improve traffic flow and management and reduce waste
- Networked transportation information kiosks to make public transportation options more appealing (e.g. by showing real bus and train arrival times)
- Better implementations of computing and software technologies to efficiently manage vehicle operation and provide efficiency feedback to vehicle operators

Smart Buildings:

There is much talk about green buildings, built to optimize energy efficiency. However, it is extremely important to make existing buildings more efficient.

Smart building infrastructure includes networked sensors, controls and software to manage, for example, responses to weather conditions, energy shortages and building occupancy patterns – saving energy and reducing CO_2 emissions.

Providing real-time feedback mechanisms, as well as easy to operate controls of things that affect power consumption, to owners and managers can significantly affect behavior.

Smart Energy Grids:

According to The Climate Group's Smart2020 report last June, the largest opportunity for ICT to decrease global carbon emissions is "Smart Grids," deploying and efficiently operating sensor, software and control systems to monitor and manage the production, transmission, distribution and consumption of electricity. They quantify the opportunity at 2.03 gigatons of carbon dioxide equivalent, worth $124.6 billion.

Ultimately, we need zero emission energy production and distribution systems, but smart energy grids can help us get there.

In almost any industry, organization, effort or human mind, information and communications technologies play an integral role in strategies to reduce human greenhouse gas emissions and avert catastrophic climate change. To enable those activities and their impacts, the U.S. needs a comprehensive, open, pervasive, high-performance, affordable ICT infrastructure – and a progressive government public policy to make it happen.

Government Must Engage to Upgrade ICT Infrastructure

In the U.S., we have long abandoned informed, rational public policy to incent and insist on adequate communications infrastructure to meet our society's needs, in favor of a hands-off approach that assumes free market forces will somehow meet everyone's needs. That approach is an uncontroversial failure, far beyond the debacle of our telecommunications industry.

It has led to competition in the wealthier, more densely populated areas that are most profitable to serve and an abandonment of large areas of the country, which are falling behind economically – and in terms of the growth and development of the human capital there.

In spite of obfuscating marketing spin to the contrary, the mission of every for-profit telecommunications company in the U.S. is currently to maximize financial returns to its investors. That goal is not in alignment with the goals of U.S. society, which should be to maximize the communications potential between all human beings in our society, to stimulate human, social and economic growth -and evolution in every dimension and at every level.

A typical household or small business may spend $100 a month on telephone and Internet services. That's $1200 a year in revenue to a Telco, which may realize a healthy $120 (10%) annual profit. However, that communications infrastructure may also enable $100,000 a year in business revenue to the household or small business and hundreds of thousands of dollars a year to local, State, national and global economies through multiplier effects. It may directly result in $20,000 a year to the Federal government in tax revenues and thousands of dollars a year to State and local governments, but it may also indirectly results in tax revenues many times higher through multiplier effects.

If that Telco does not elect to provide communications services to that household or small business, because that incremental decision results in no incremental profit, it is a rational business decision. The mission of the company is to maximize returns to its investors. However, the impact to society may be the loss of hundreds of thousands of dollars in economic and other benefits.

It may be a rational business decision for many Telcos to build infrastructure into the same location, if the costs are relatively low and the prospects for revenues in that location are high, even though a single build into that location could technically, adequately meet the needs of all of the human beings and organizations in that location. That results in market inefficiency. From the perspective of society, we have wasted resources to duplicate efforts in one location, creating a scarcity of resources to serve other locations.

It is the job of government to take the broad society perspective and realize ICT infrastructure is essential strategic infrastructure. The benefits of that infrastructure to society, and the human beings within it, far exceed the financial returns to whoever pays to install that infrastructure and charges for use of it.

In the 20th century, would it have made sense to leave decisions about where to build roads up to private businesses, based on their analyses of how much money they would make charging people tolls to use the roads and advertisers to put up billboards beside them? No, because the benefits to society of those roads far exceeded any prospects for collecting toll and advertising revenue. If we had, we'd have roads for densely populated and wealthy areas only, leaving huge areas of the country un- or under-served and abandoning billions of dollars in economic benefits.

A few years ago, the Gartner Group conducted a study of the economic impact to California if 1Gbps network connectivity was established for all Californians. It concluded that infrastructure would lead to an increase in California's Gross State Product (GSP) of $376 billion per year.

Assuming California is no more than 1/3 of the U.S. economy, the impact to U.S. Gross National Product of 1Gbps network connectivity would be at least $1 trillion ($376B * 3).

Assume it would cost U.S. society $1 trillion to efficiently deliver 1Gbps to all Americans (maybe a third of the costs of the most recent Iraq war, for which we reaped enormous negative returns, and about a seventh of the total cost of Wall Street bailouts in the current financial crisis).

As U.S. society, for a $1 trillion investment, we could put hundreds of thousands of Americans to work (because we can't outsource physical infrastructure work) building critical, future-proof ICT infrastructure to enable enterprise, innovation and growth we cannot even imagine yet and create at least $1 trillion a year in returns to our society.

$1 trillion investment for $1 trillion annual returns; that's a 100% annual return on investment for the aggregate U.S. society and economy.

If that decision is left to private, for-profit enterprise, they may rationally choose not to do it, because their financial returns may only be $10 billion a year (1%), and investors can get better returns elsewhere. Or, they may decide to do it only in the places where they get adequate financial returns, creating gross imbalances in economic activity and benefits across society.

Government either has to do this itself or it has to develop careful public policy to create a playing field that incents and polices other enterprise to do it.

From the perspective of U.S. society, it is an absolute no brainer to make the $1 trillion investment in high-performance, gigabit+ fiber communications infrastructure for a 100%, $1 trillion return on investment annually, plus extraordinary other intangible benefits. Even if, and especially because, private industry will not rationally do it, it is necessary for government to do it or to create an economic and regulatory playing field that forces or incents private enterprise to do it.

Government must take action on implementing and managing critical, strategic ICT infrastructure.

US Broadband Coalition (BB4US)

There has long been an almost deafening roar from citizens, companies, organizations, public figures, politicians, publications and others bemoaning the sad state of critical communications infrastructure in the U.S., especially relative to other nations with rational and progressive communications infrastructure policies and momentum, and demanding the U.S. to develop a rational and progressive public policy to create a functional, modern ICT infrastructure.

The Baller Herbst Law Group led an effort to gather diverse, interested parties to develop counsel and advice to the Obama administration in developing the U.S. government's position on communications infrastructure.

That effort was based on a Call to Action, which described the issues and a set of placeholder, recruiting goals for the effort:

> **Goals**. The National Broadband Strategy should set out several clear, forward-looking, and attainable goals that take into account the ability of broadband to generate huge benefits in education, environmental protection, scientific research, medicine, health care, energy efficiency, transportation, and overall economic vitality. These goals should include the following:
>
> a. Every American home, business, and public and private institution should have access to affordable high-speed broadband connections to the Internet.
>
> b. Access to the Internet should, to the maximum feasible extent, be open to all users, service providers, content providers, and application providers.
>
> c. Network operators must have the right to manage their networks responsibly, pursuant to clear and workable guidelines and standards.
>
> d. The Internet and broadband marketplace should be as competitive as reasonably possible.
>
> e. U.S. broadband networks should provide Americans with the network performance, capacity, and connections they need to compete successfully in the global marketplace.

That Call to Action resulted in a large number of high quality people joining this collaborative, which was divided into a series of working groups:

> Working Group on Need for a National Broadband Strategy
>
> The broadband-enabled Internet is rapidly changing the world. It has become a catalyst for innovation, economic growth, job creation, educational opportunity and global competitiveness. It enhances public safety, homeland security, health care, energy efficiency, environmental sustainability and the worldwide distribution of millions of products, processes and services. It aids in revitalizing depressed urban and rural economies and addressing the special needs of senior citizens, individuals with

disabilities, and young people. It creates a vehicle for enhancing the level of civic participation and discourse so important to a functioning democracy. The mission of this working group is to demonstrate why the United States urgently needs a comprehensive national broadband strategy in order to take maximum advantage of the vast potential benefits of the broadband-enabled Internet.

Working Group on Goals

All members of the US Broadband Coalition endorse the goals in the Call to Action, but not necessarily on how to achieve them. For example, some members believe that the United States should strive to be a "100 Megabit Nation" by 2015, while others believe that such a goal is either too ambitious or not ambitious enough. Some members focus on particular technologies, while others argue for technology-neutral performance standards. Some call for universal standards, while others call for different standards for different situations. Some emphasize preserving an open Internet, while others emphasize flexibility in network management. The mission of the Working Group on Goals is to explore these issues in greater depth and develop as much agreement on them as possible.

Working Group on Metrics

Timely, accurate, and trustworthy data on current and future deployment, adoption, and use of broadband connections to the Internet are essential at every step in the process of developing and implementing a National Broadband Strategy. Good data are necessary to establish meaningful goals, to evaluate how well we are doing in meeting these goals, to make appropriate policy adjustments if we are not, to ensure accountability, and to compare our performance with that of other leading nations in an increasingly competitive global economy. Service providers and investors need good data to make sound investments. Users of broadband connections need good data to make wise choices among available options. The mission of the Working Group on Metrics is to develop as much agreement as possible on the nature, quality, and timeliness of the data needed for all of these purposes, and on how such data should be collected and disseminated.

Working Group on Availability

All members of the US Broadband Coalition agree on the need for policies that would increase availability of robust broadband connections to the Internet. The mission of the Working Group on Availability is to identify and build consensus on short-term and long-term policies to stimulate sustainable investments in broadband infrastructure and to mitigate financial, legal, and regulatory barriers to such investments. To some extent, the mission of the Working Group on Availability will overlap with that of the Working Group on Adoption and Use, as the supply-side considerations affecting the availability of broadband connections to the Internet are significantly affected by a variety of demand-side considerations, including price and quality of such connections, citizen education, access to computers, etc. The Working Group on Availability will focus primarily on the supply-side considerations.

Working Group on Adoption and Use

The mission of the Working Group on Adoption and Use is to investigate why residential, commercial, and institutional users do or do not use the Internet; to examine how broadband connections to the Internet can facilitate, expand, and improve such use; and to develop consensus on promising approaches to increasing adoption and use of broadband connections to the Internet. The Group will not merely address unserved or underserved areas but will also explore ways to stimulate use of broadband as a driver of economic development, educational opportunity, public safety and homeland security, affordable modern health care, environmental sustainability, energy efficiency, improved government service, etc. To some extent, the mission of the Working Group on Adoption and Use will overlap with that of the Working Group on Availability, as physical availability of networks, price and quality of services, consumer education, access to computers, accessibility for people with disabilities, and many other considerations, interact with each other. The Working Group on Adoption and Use will focus on these issues primarily from the perspective of potential broadband users.

Working Group on Implementation

A nation as complex as the United States will necessarily require a multi-faceted National Broadband Strategy. Such a strategy, in turn, will pose significant implementation issues at all levels of government. The mission of the Working Group on Implementation is to identify these issues and develop as much agreement as possible on how they should be resolved.

Goals Working Group

The purpose of the Goals Working Group is to dig deeper into the Call to Action placeholder goals and develop recommendations on how they could be improved.

Discussion of Goals

U.S. Society Perspective

The first goal should be to agree to approach the problem from the perspective of what's best for all of U.S. society. This may sound obvious. However, many of our problems result from fragmentation. Problems are addressed locally or regionally, from the perspective of various established corporate interests, from the perspective of entrepreneurs hoping to make money, through various vested regulatory system interests, or through other more narrow agendas.

Many efforts to develop legal, policy and regulatory frameworks suffer, because parties involved in the planning are largely motivated to shape plans in ways that allow their more narrow interests to benefit. Their goal is not to optimize a solution from the perspective of society. Rather, it is to shape the playing field so they profit or preserve their advantages in their game. All interests and viewpoints are part of the society perspective, but planning needs to be optimized for the whole of society.

What is the optimal solution for providing communications technology infrastructure for all of U.S. society: including future large enterprises, rural families, home and mobile workers, technology developers, digital entertainment companies, information and communications technologies service providers, and government? How can we most efficiently meet the future, diverse needs of our U.S. society for communications technology infrastructure?

This is an essential foundation for good planning.

Planning Horizon

Our next goal is to agree that we are planning for the future, not the present. This sounds obvious, but often it is not. We need to state this explicitly.

It will take years to implement any plans developed. In that time, technology and demands will continue to advance rapidly. It doesn't work to plan to meet current demands. We plan to meet future demands, many of which do not exist yet. (The solution is inadequate, and the public is not satisfied, when we take 5 years to build a bridge to accommodate traffic observed during the planning period, only to find when the bridge opens traffic volumes are much higher.) Our planning horizons in this country have been too short, causing us to always be behind.

We need to design and build essential communications technology infrastructure to meet our needs for the rest of this century. What will demands for information and communications technology infrastructure look like in 50 years? How can we design and optimize our communications technology infrastructure to efficiently meet our needs for at least the next 5 decades?

Descriptive Label

"Broadband" is a word with almost no meaning. It means something like "a data communications connection faster than a dial-up analog modem." Ten years ago it meant something. Today, certainly, in planning for the future it is not meaningful or useful. We need a simple descriptive phrase for a public policy plan to create a

future-proof, essential information and communications technology infrastructure to meet the diverse future needs of U.S. society.

"*Information and Communications Technologies (ICT) Infrastructure*."

ICT is an umbrella term, widely used outside the U.S. and by the U.N., to encompass all rapidly emerging, evolving and converging computer, software, networking, telecommunications, Internet, programming and information systems technologies.

Historically, many of these fields developed separately: in different companies, departments and R&D groups; and at different times. With rapid improvements in computer processing power, networking technology advances, programming interface improvements, widespread adoption of Internet Protocols, integration into organizational strategic operations, and improved workforce and user competencies, however, these fields are rapidly converging.

Equipment is converging into ever fewer devices. Previously separate networks are converging. Previously separate organizational departments are converging into single operations. In the U.S., these trends are often referred to as "convergence." In the rest of the world, all of these technologies are grouped together under a single descriptive term, Information and Communications Technologies (ICT).

The United Nations, for example, uses ICT in its Global Alliance for ICT and Development, a global forum and platform for policy development, Information and Communications Technologies Task Force and UNESCO.

The European Union uses the term ICT, for example in its ICT Task Force, which conducts research and develops policy recommendations, and at CORDIS, for strategic R&D. EU foreign aid efforts focus on ICT in Latin America and Africa, China, Asia/Pacific, and the rest of the world.

ICT is used in Australia, for example, by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), its national science agency and one of the largest and most diverse research agencies in the world. Also using the ICT term are New Zealand, much of Africa, Canada, the International Telecommunications Union (ITU) and the World Bank. The term ICT is emerging as global standard terminology.

Curiously, ICT is currently rarely used or recognized in the U.S. To function efficiently in a global economy, we should use the same terms. Regardless, we need something intuitively meaningful.

It is useful to frame the topic as essential public infrastructure, like roads, bridges, water and sewer systems and electricity distribution systems. People confuse essential ICT infrastructure with the value-added services it enables.

Specify Technological/Design Demands

Applications

To design a solution, we need to know what we are designing for. What are the (future) users and applications that need to be supported, and what do they need to function well? What are the most demanding users and applications that need to be supported? What are other likely user and application profiles?

Currently, they include at least the following applications requiring less than 100Mbps of bandwidth:

- Telephony
- Telecommuting (converged services)
- File Sharing (large)
- IPTV-SD (multiple channels)
- Switched Digital video
- Video on Demand SD
- Broadcast SD Video
- Video Streaming (2-3 channels)
- HD Video Downloading
- Low Definition Telepresence
- Gaming
- Medical File Sharing (basic)
- Remote Diagnosis (basic)
- Remote Education
- Building Control & Management
- Telemedicine
- Educational Services
- Broadcast Video SD and some HD
- IPTV-HD
- Gaming (complex)
- Telecommuting (high quality video)
- High Quality Telepresence
- HD Surveillance
- Smart/Intelligent Building Control
- Streaming Video
- Standard Definition Digital Television
- HD Videoconferencing
- Video Home Security Service
- High Definition Digital Television
- Telepresence: Very High-Resolution HD Videoconferencing

Currently, they also include at least the following uses requiring more than 100Mbps of bandwidth:

- HD Telemedicine
- Multiple Educational Services
- Broadcast Video full HD
- Full IPTV Channel Support
- Video on Demand HD
- Telepresence (Very High-Resolution HD Videoconferencing)
- Gaming (interactive immersion)
- Remote Server Services for Telecommuting

Planning for the future, they include high-performance applications with unclear demands for bandwidth, including future generations of high-definition video.

From the perspective of society, we want to enable productive use of any of these applications, and of applications that have not yet been created, by anybody anywhere.

Application Performance Requirements

Bandwidth

Again, "broadband" tells us almost nothing about data transfer speed, which is one of the most important measures of demand. We need to estimate demands for future data transfer throughput by various users. Those include large enterprises, academic researchers with huge data sets, rich media content developers, medical imaging record users, high definition film distributors, gamers. What will the progressive technology companies of the future need in terms of data transmission speeds?

A decent measure of standard speeds demanded is to look at the standard network interface cards on a standard user device sold in standard stores. Today, that standard is at least 100Mbps Fast Ethernet for a consumer computer. (My laptop has a gigabit Ethernet card.) For enterprise network switches and routers, that standard is currently measured in one or more gigabits per second.

Decades from now, what are the demands for data transmission speeds likely to be? One or more gigabits per second. Users are also likely to demand lower bandwidth increments at lower price levels.

Reliability/Availability

How important is it to future users that their network is always available for their use? How much down time can they tolerate? Service Level Agreements for reliability/availability are usually expressed in percentages. The network is designed and guaranteed to be available for use a certain percentage of the time. Key elements of the Public Switched Telephone Network (PSTN) were designed for "Five 9's," 99.999% availability. How do we want to specify network availability for the American ICT infrastructure of the future? Why would we reduce the performance of next generation network performance below that of past generations? 99.999% is the goal.

Security

It is likely users will demand that their uses of the network are private and secure. We should specify that individual network communications are secure from interception and abuse by others.

Latency

Independent of bandwidth, how fast should data transit defined elements of the network? What is the delay in getting data packets from one point to another? Some applications demand low latency. 2ms within a metro

Packet Delivery

How tolerant will future users be of dropped packets? How do we specify that demand? SLAs are usually measured in percentage of packets successfully delivered. 100% successful packet delivery is a good goal.

Jitter

How much divergence will future applications tolerate between the delivery of successive data packets? 2ms within a metro is a starting point.

Demarcation

Where does user responsibility for the network begin and service provider responsibility for the network end? Define a network termination point, typically a patch panel or jack of some sort.

3rd Party Service Provider Interconnection

How do 3rd party service providers connect to the network? How are they charged for network services? What choices do they have? How do we ensure terms are reasonable? How do we ensure non-interference with their services by a potentially competitive network operator? Do we specify billing mechanisms? How do we regulate compliance?

Transport Service Definition

What are we trying to create or incent via public policy, and what do we want to not interfere with and leave to competitive market forces? Look at the OSI model. We want regulated transport service providers incented by public policy to provide layers 1 through 3 of the OSI model: 1) physical (fiber, conduit, towers, transmission equipment, rights of way, trenches, poles, etc), 2) data link (reliable transmission of data, like Ethernet), and 3) network (basically, support of TCP/IP). All layers above layer 3 in the OSI model are competitive.

What is the transport service we are trying to incent with public policy? Long-haul and backbone networks are functioning well as competitive markets. First mile/last mile networks are the market failure in the U.S. We need to create efficient, appropriately designed, high performance, future-proof network solutions to regionally connect end users at their homes, offices and mobile devices to data centers, backbones, service providers and each other.

Transmission Media

For more than a decade, it has been transparently clear that single-mode optical fiber is a much higher performance, more reliable, more versatile and future-proof transmission media than anything else available.

Optical Fiber is:

- Largely immune to electromagnetic interference problems that plague copper
- Very difficult to tap undetected
- Capable of very long transmission distances without regeneration
- Capable of extraordinarily high bandwidth and high performance transmission

Over optical fiber, it is currently very possible to offer services in almost any bandwidth increments and to offer multiple services that are separate and undetectable by the other. Out of the box GBICs costing a few hundred dollars provide 1Gbps of throughput at wire speed and without jitter, dropped packets or other performance problems. 10Gbps is a standard network interface available today over optical fiber. Dense wave division multiplexing can currently deliver some 40 wavelengths at 40Gbps each over two single mode fibers about the diameter of two human hairs. Bandwidth and many other performance issues simply go away with fiber.

It is a no-brainer for a future looking, public minded, essential and strategic ICT infrastructure to require optical fiber throughout terrestrial networks.

Upgradeability

Do we want to specify now that the network deployed has to include in its design efficiency for future upgrades? Requiring adequate conduit systems, for example, simplifies future replacement of transmission fiber or wires. Specifying an adequate fiber quality allows major future performance improvements without replacing transmission media, just swapping out the electronics.

Aesthetics

Should we consider an undergrounding requirement?

Truthfully, much of the U.S. looks like a 3rd world country, with a tangle of overhead wires hanging from rotting, 50 year old utility poles, obstructing views, creating vulnerabilities to outages in storms and making the experience of being a U.S. citizen physically ugly.

A truly modern ICT infrastructure would include rational conduit and cabling systems (including unused conduits and spare cables), in coordination with other essential utility services, digging up the streets once and doing the job right, rather than having a chaotic system of street digging and disruption, which drives municipalities crazy.

Think of the jobs to Americans and the long-term benefits to society of all U.S. communications and electricity infrastructure installed efficiently underground, so we don't have to dig up streets any more or have ugly wires overhead.

Ubiquity/Universal Service

We want this critical, strategic ICT infrastructure to extend to every American household and business. We do not know where innovation will take place, and we want to enable it everywhere, so people in rural communities have the benefits of access to educational, social and business resources, and so they are enabled for productive participation in 21st century information and knowledge economies.

Universal service was an essential design component of the Public Switched Telephone Network, and we should insist on nothing less for the future. We provide service to everyone, we divide the total costs by the number of users and we provide non-discriminatory services and pricing to anyone, anywhere (with some defined exceptions, for example to address the Digital Divide).

Non-Discriminatory Wireline 3rd Party Network Interconnection and Use

Rationally, given their missions of maximizing profits to investors, most communications service providers control very carefully the network infrastructure over which they deliver value-added services. The network access and transport services are considered commodity, low-margin businesses. The value-added services are where the fat margins and profits are.

Rationally, companies are incented only to provide infrastructure capacity to meet the demands for their own services they hope "their" customers will buy. If they give competitors use of those assets to access "their" customers, they don't have enough use of those assets to serve "their" customers themselves. They can't stand the idea of doing this.

Rationally, companies want monopoly control of these strategic customer access assets, so they maximize their opportunities to extract wealth from those customers. Rationally, they do everything they can to keep competitors from making productive use of their network assets to serve what they view as their customers. The games in this area are ugly: legal challenges, regulatory fights, creating burdensome administrative and technical interconnection processes and requirements, deliberate sabotage, delivering lower quality transport for competitors than for their own value added services, delayed installations…

From the perspective of society, however, we are not well served by these behaviors. Society is better off if a citizen can get a wide variety of competitive services from a wide variety of innovative service providers over a single, efficient, high performance infrastructure.

The only way to achieve this without an ongoing structural incentive for abuse is by structurally separating the essential public ICT infrastructure and transport services from the higher layer value added services, so all ICT value added service providers use the same transport infrastructure under the exact same terms, with the exact same collocation and interconnection requirements, getting the exact same services with the exact same performance.

All essential, strategic first-mile/last-mile and middle-mile, layer one through 3, infrastructure and transport services have to be open to all layer 4 through 7 value added service providers under the same terms.

Non-Discriminatory Wireless Service Provider Interconnection and Use

Most wireless technologies discussed in the context of public "broadband" are access technologies. They create a way for a user device to connect with a terrestrial wireline network. The quality of wireless networks is therefore not just a product of the wireless technologies, but also a product of the wireline network those wireless nodes are attached to.

It is quite typical for a household consumer to have a 802.11g WI-FI router that connects end user devices to the router at 54Mbps, or an 802.11n WI-FI router that connects end user devises to the router at perhaps 300Mbps. However, that router is connected to a Telco DSL service at 3Mbps. Therefore, communications beyond the range of the WI-FI router are choked to 3Mbps. Wireless system performance is limited by the performance limitations of the associated wireline network.

This situation exists for wireless service providers also, who could provide much more robust and better performance wireless network services if they could adequately and cost effectively connect with high-performance terrestrial networks. We need to be able to create higher node densities and radios to connect to high performance wired networks to improve performance and reduce transmission power and improve public health in radio communications networks.

Any 3rd party service wireless provider has open access to the essential, high-performance ICT wireline strategic infrastructure under the same terms and conditions as any other.

Regulation

Like it or not, first mile/last mile ICT infrastructure is a natural monopoly. From the perspective of U.S. society, it makes no more sense to have competitive communications conduits or wires coming into homes than it would to have multiple water or sewer pipes, or multiple electricity wires. The capital costs of last mile networks are so high, it makes sense to have one company do it once. That is the most efficient solution from the perspective of society.

Our group believes this issue is contentious and divisive, because of the difficulty of determining who should be the monopoly provider, or what happens to companies that have tried in good faith, according to free market U.S. public policy of the last decade(s), to invest in local access.

Even if we do not address this issue, there will still be local monopoly conditions in any first mile network operation engaged with ICT infrastructure public policy. Monopolistic behavior is well-documented human behavior. We have to consider it, as long as monopolistic, duopolistic or oligopolistic market conditions exist.

From the perspective of U.S. society, we need strict regulatory oversight of essential ICT infrastructure local access solutions. That is particularly true if public money is going to those solutions. The layer 1-3 infrastructure and transport service providers have to be regulated, at both the Federal and State levels. We have seen the tragic results of a lack of adequate regulation in financial markets, and we cannot allow that to happen with a new ICT infrastructure.

Education

The benefits to U.S. society and economies of cutting edge ICT infrastructure will mostly be realized by those who adequately understand how to use it. There is a knowledge and skills divide in this country that needs to be addressed as part of this effort. We need to develop basic U.S. ICT User Proficiency standards and a credential certifying basic ICT User Proficiency and push that out through our society. Doing so would assure schools accepting transfer or graduating students from other schools that students have the ICT knowledge and skills needed to be successful in their schools. It would also allow employers to know that prospective employees have the basic user knowledge and skills needed to be productive in their work environments.

To develop competent ICT users and citizens, we also need to provide adequate resources for schools to be able to make optimal use of ICT infrastructure. They need end user devices for students, staff and teachers, upgrades to campus wiring, networking equipment and other infrastructure and software applications optimized for the new environment. As a society, we need to make these investments in ICT infrastructure in schools also.

Digital Divide

There is a gross imbalance in the distribution of wealth, knowledge, property, skills, power and influence in this country. To maximize the impacts and economic returns of national ICT infrastructure investments, we have to also address the financial abilities of citizens to be able to afford to connect to that infrastructure, learn how to make use of it and have the end user devices they need to make use of it. Simply put, there are many Americans all over this country who could not afford to pay high service fees to connect to this infrastructure, who cannot afford computing devices and who cannot afford to learn how to use them. We have to address that problem.

We need some kind of discount or subsidization mechanism to assist our citizens who need financial help to cross the digital divide and participate in and realize the benefits of our 21st century knowledge and information economies.

BB4US Revised Goals

Our Broadband Coalition goals should recommend to U.S. government policymakers:

1. Begin with a long-term planning horizon of at least 50 years.
2. Plan from the perspective of what is best for U.S. society.
3. Define the issue as a progressive, long-term modernization of essential, strategic Information and Communications Technologies (ICT) infrastructure and market structure.
4. Describe the opportunity for an unprecedented paradigm shift to accelerate the evolution of humanity and human society and enable new, 21st century Knowledge and Information Economy growth.
5. Insist on universal service, without discrimination in the availability, quality or pricing of services (except for 13 below).
6. Insist on high-performance optical fiber for terrestrial wire-line network transmission media.
7. Define minimum initial Service Level Agreement attributes for first/last mile and middle mile regional infrastructure transport services.
    a. Bandwidth:
        i. Any 5Mbps increment up to 100Mbps
            1. 25% of population by 2012
            2. 100% of population by 2015

ii. Any 100Mbps increment up to 1Gbps
    1. 25% of population by 2012
    2. 50% of population by 2015
    3. 100% of population by 2020
iii. Any 1Gbps increment up to 10Gbps
    1. 25% of population by 2015
    2. 50% of population by 2020
    3. 100% of population by 2025
iv. Further upgrades evaluated and set in the future based on observation of demand

b. Reliability/Availability:
    i. 99.999% or customer receives partial refund
c. Security:
    i. 100% or transport provider is penalized
d. Latency:
    i. 2ms within a metro
e. Packet Delivery:
    i. 100% or customer receives partial refund
f. Jitter:
    i. 2ms within a metro
g. Demarcation:
    i. Defined patch panel or jack location

8. Insist on complete structural separation between the regulated, natural monopoly, layer 1-3, first/last mile and middle mile regional infrastructure and transport service providers created or incented by government action and all layer 4-7 value-added service providers – even if that means breaking up existing companies.
9. Insist that regulated, natural monopoly, layer 1-3, first/last mile and middle mile regional infrastructure transport service providers created or incented by government action provide their services without discrimination to all end users and all layer 4-7, wireline and wireless, value-added service providers.
10. Use public money to pay for a large percentage of the capital investments required, so this is implemented quickly and economic

benefits begin accruing to American society quickly. Consider no/low interest loans.

11. Establish strict Federal and State regulatory oversight of natural monopoly, layer 1-3, first/last mile and middle mile regional infrastructure and transport service providers.
12. Fund development of national ICT User Knowledge and Competency Standards and one or more associated ICT User Knowledge and Competency Certifications.
13. Establish a mechanism to fund or subsidize end user devices and ICT services for those who cannot reasonably afford them to address the "Digital Divide" problem.
14. Encourage free-market competition everywhere except for regulated, natural monopoly, layer 1-3, first/last mile and middle mile regional infrastructure transport service providers.
15. Encourage undergrounding of ICT infrastructure, in cooperation with other regulated utility infrastructure (gas, sewer, water, electricity and conduits) for health, aesthetic and economic stimulus benefits.

Conclusion

It is extraordinary to be alive when we have the opportunity to proactively create a radical paradigm shift in the evolution of humanity.

By enabling unprecedented, efficient communications between humans and between humans and their worlds and tools, we can accelerate the advance of humanity, society, civilization and economic activity in ways never before possible. We can transform society and position the U.S. to lead in the information and knowledge economies of the 21st century, restoring quality of life and livelihoods for millions of Americans.

This will only happen through the action of government, because for-profit business will never rationally decide to do it.

We have to step out of our little shells and think big on this one. It's bigger than sending men to the moon, and the benefits to our society are potentially exponentially greater.

Rise up to the challenge!

Let's make this society great again!